* THE DEVELOPMENT OF A MODEL TO MEASURE RELATIVE RECREATION WORKLOADS

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*Fulfillment of a requirement of The Outdoor Recreation Management Short Course, Clemson University, Fall, 1982.

ABSTRACT

Within the National Forest System, various functional targets are assigned to units and sub-units. These targets are in readily measurable units such as miles of landline, acres of regeneration, or thousands of board feet. The target units usually represent a readily identifiable work-load to the units.

Unfortunately, this is not the case within the various 070 functions (recreation management). In Region 8, recreation targets are assigned as full service PAOT Days and reduced service PAOT Days. The difference in full service and reduced service is often minor and does not reflect an accurate indication of work load.

Twenty different models which measure relative recreation workloads (RWL) were developed and evaluated. Model 13 proved to be the model which deviated the least from the average of all twenty models.

Potential uses of RWL are also discussed.

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I. INTRODUCTION

Within the National Forest System, various functional targets are assigned to units and sub-units. These targets are in readily measurable units such as miles of landline, acres of regeneration, or thousands of board feet. Funding for the various functions is alloted on a per unit basis. For example a district might receive $100 per acre for its regeneration program with total funding being the total regeneration acres times $100 per acre. The target units usually represent a readily identifiable work-load to the units.

Unfortunately, this is not the case within the various 070 functions (recreation management). In Region 8, recreation targets are assigned as full service PAOT Days and reduced service PAOT Days. The difference in full service and reduced service is often minor and does not reflect an accurate indication of work load. The following table shows the final 1982 budget and the total PAOT Days by Forest.

TABLE 1

NATIONAL FOREST	FY 82 Funding	PAOT DAYS	Funding/PAOT DAY
Alabama	250,000	1,234,258	.2026
Daniel Boone	834,000	4,473,118	.1864
Chattahoochee-Oconee	561,000	2,495,535	.2248
Cherokee	475,000	3,366,880	.1411
Florida	950,000	4,715,860	.2014
George Washington	725,000	2,880,899	.2517
Kisatchee	276,000	1,480,540	.1864
Mississippi	264,000	1,103,850	.2392
Ouachita	489,000	2,898,383	.1687
Ozark	1,565,000	2,113,965	.7403
North Carolina	743,000	4,398,705	.1689
Francis, Marion& Sumter	306,000	1,553,543	.1970
Texas	582,000	3,072,600	.1894
Jefferson	453,000	2,458,755	.1842
Caribbean	147,000	507,350	.2897
TOTAL	8,620,000		

Funding rates vary from a low of slightly more than $.14 per PAOT Day to slightly more than $.74 per PAOT Day. It is obvious from this, that funding to forests in Region 8 is not directly related to the assigned targets.

The question was then posed, "do the assigned targets accurately represent the recreation work load?" After studying PAOT Days and the type of sites to which those days were assigned, on the 15 National Forests in Region 8, it became apparent that PAOT Days were not an accurate measurement of work load.

A study of other measurements of recreation work load such as use and number of sites revealed that more than one measurement would have to be used in order to accurately measure recreation workload.

The purpose of this project was to develop a model which would accurately measure the relative recreation workload (RWL) of units within a group, such as districts on a forest or forests within a region.

If such a model could be developed, relative recreation work loads (RWL) could then be used by managers as an aid in budget development, land management planning, and target assignment.

II LITERATURE

A search of literature revealed only two sources directly related to this subject. Neither source provided a great deal of information. Shilling provided the RWL for each forest in Region 8 used in Model 14. A computer search by SOUTHFORNET revealed only one source - RIM, a computer oriented system for the management of information about people, places and things over periods of time. USFS 1968.

III METHODOLOGY

The methodology used to develop the Cherokee RWL Model was as follows:

A. Define the unit and subunits to be used for model development.

B. Identify various indicators of RWL.

C. Evaluate those indicators for availability and value as indicators.

D. Develop a number of models which would utilize a wide range of indicators and represent a variety in complexity.

E. Compare the resulting RWL of each model to the average RWL for all models for each subunit.

F. Select those models which appear to vary the least from the average.

G. Compute the total and average deviation from the average for each of the six remaining models.

H. Select the model which has the smallest average and total deviation.

A discussion of each of these steps explains the assumptions and reasoning used throughout the methodology.

A. Definition of Unit and Subunit

Region 8 was selected as the unit and the 15 National Forests in Region 8 as the subunits.

There were three alternatives available for selection as the unit and subunits. The first was the National Forest System as the unit and

and the Regions as the subunits. This alternative was not chosen because of the amount of data which would be involved and the fact that a computer would not be available to analyze that data.

The second alternative was the Cherokee National Forest as the unit and the six Ranger Districts as the subunits. This alternative was not selected because the RWL of the Cherokee National Forest represented such a small portion of the NF's total. (Shilling, 1982).

The third alternative was selected. Region 8 represents approximately 12 percent of the system RWL (Shilling, 1982) and yet the volume of data could be analyzed without the aid of a computer.

B. Identification of Indicators

This step consisted of a brainstorming session at which any possible indicator was listed. The potential value or availability of data was not considered. Those indicators which were identified are listed in Appendix A.

C. Evaluation of Indicators

Three main criteria were used to evaluate indicators which had been identified in the brainstorming.

The first criterion was availability of data. Data for indicators must be readily available. Data for those indicators selected for use in model development were taken directly from various RIM Special Reports or other routine reports. Sources for data for each of the selected indicators are listed in Appendix B. Data for each subunit must also be readily convertible to a percentage of the unit total.

The second criterion was the value of the indicator. A subjective value was placed on indicators. Only those which appeared to have a direct link to RWL were used. Those indicators which did not directly relate to the 070 function were eliminated. For example, the number of miles of trails was eliminated but the use of trails was included (in dispersed areas).

The third criterion was the reliability of data. For example, dispersed use in RVD's was selected for use, but it was not as reliable as developed use. Developed use is an estimate, but it is based on sampling. Dispersed use is almost pure guesswork. Developed use was often given a higher weight factor than the dispersed use for that reason.

It must be pointed out that most of the evaluation of indicators was of a subjective nature. Another researcher or analyst might well have selected different indicators. Definitions for each indicator are listed in Appendix C.

D. Model Development

Each model was developed independently of others. While some use the same indicators, the weight factors given to those indicators vary. This was done to create a broad spectrum of weightings for the various indicators. Each model calculates the RWL in percent of each of the 15 National Forests in Region 8. A detailed discussion of each model and the RWL for each National Forest follows. Mathematical formulas for each model are located in Appendix D. All data are from fiscal or calendar year 1982. Regional total percentages should be exactly 100 percent. These totals were not rectified and therefore are not exactly 100 percent.

Operational Costs, Maintenance Costs, and Total Costs were taken from the RIM Facility Condition Report, and represent what is necessary to manage areas at a high level of full service. Forest overhead costs are not included unless the forest includes them in the District costs.

Matrix 1 shows the weight factors given each indicator by model. Matrix II shows the RWL for each model by National Forest.

I. Model 1

Ten indicators were used in Model 1. They represented a broad spectrum of indicators. The percent of the Region total was calculated for each indicator by Forest. Each indicator was given a weight factor. Weight factors were multiplied by the indicator percent. Weighted percents were totaled and divided by 26 (the total of weight factors).

2. Model 2

The same ten indicators used in Model 1 were used in Model 2. Only the weight factors were changed. This was done to give a variety in weight factors. The percent of the Region total was calculated for each indicator by Forest. Each indicator was given a weight factor. Weight factors were multiplied by the indicator percent. Weighted percents were totaled and divided by 23 (the total of weight factors).

3. Model 3

The same 10 indicators used in Models 1 and 2 were used in Model 3. No weight factors were assigned to the indicators. This represents a straight average. The percent of the Region's total was calculated for each indicator by Forest. Percents were then totaled and divided by 10 (the number of indicators).

MATRIX 1 INDICATORS AND WEIGHT FACTORS FOR EACH MODEL

INDICATORS	Model Number and Weight Factor (Weight Factor shows Indicators used by Model)																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Developed Use	5	3	1	3	5	1	5	3	1	-	-	-	-	-	-	-	-	-	-	-
Dispersed Use	1	1	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-
Wilderness Use	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Recreation Fees	3	3	1	2	3	1	3	3	1	1	1	1	1	-	-	-	-	-	-	-
Fee Area PAOT	3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-Fee Area PAOT	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Number of Non-Fee Areas	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Number of Fee Areas	3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Operational Costs (from RIM Facility Condition Report)	4	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maintenance Costs (from RIM Facility Condition Report)	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total PAOT	-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Costs (from RIM Facility Condition Report)	-	-	-	2	3	1	-	-	-	-	-	-	1	-	-	-	-	-	1	1
Total Use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Operational Cost Use	-	-	-	-	-	-	-	-	-	-	-	2	2	-	1	-	1	1	1	-
Maintenance Cost Use	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1	1	-
Operational Cost Capacity	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-	-	1	1	-
Maintenance Cost Capacity	-	-	-	-	-	-	-	-	-	-	-	2	1	-	1	-	1	1	1	-
Total Cost Use	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	1	-	2	-	-
Total Cost Capacity	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	1	-	2	-	-
PAOT Days	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1

MATRIX II RWL in Percent by Forest

National Forest	Model Number and RWL (in percent) by National Forest																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Alabama	3.65	3.75	3.68	3.48	3.40	3.60	3.39	3.31	3.66	3.34	3.22	3.54	3.23	3.58	3.76	3.62	3.82	3.69	3.62	3.59
Daniel Boone	7.79	7.69	7.58	8.89	8.74	8.99	8.31	8.46	8.52	8.11	8.29	8.38	8.31	8.69	8.23	7.90	8.21	8.06	8.36	8.17
Chattahoochee-Oconee	7.32	7.47	8.32	6.42	6.21	6.79	5.44	5.53	6.27	7.33	6.96	6.14	6.53	7.51	6.67	7.51	6.65	7.31	6.84	7.13
Cherokee	9.31	9.10	8.77	9.28	9.48	8.74	10.21	9.48	9.00	8.94	8.60	8.41	8.45	8.48	8.94	9.46	8.79	9.20	8.66	8.87
Florida	11.36	10.81	9.65	13.84	14.57	12.70	18.00	17.76	15.46	13.39	14.51	14.81	13.42	10.85	13.37	11.70	13.68	12.53	12.24	10.17
George Washington	7.62	7.78	7.47	7.23	7.00	7.50	5.37	5.48	5.79	6.76	6.51	6.29	6.68	6.83	6.29	7.14	6.43	6.71	7.07	6.29
Kisatchie	2.79	2.76	2.56	2.69	2.66	2.64	2.54	2.68	2.43	2.51	2.70	2.59	2.49	2.64	2.27	2.22	2.32	2.25	2.32	2.28
Mississippi	3.28	3.31	3.20	3.01	2.95	3.23	2.76	2.68	3.23	2.81	2.59	3.08	3.15	4.41	3.33	3.14	3.47	3.22	3.36	3.66
Ouachita	5.65	5.91	5.97	4.87	4.50	5.21	3.41	3.53	4.17	5.23	4.87	4.81	4.98	6.21	5.17	5.77	5.24	5.67	5.19	5.07
Ozark	9.43	9.45	8.17	10.55	11.04	10.16	12.10	13.39	11.24	10.35	12.36	10.54	10.02	5.41	7.58	7.32	7.56	7.45	8.38	7.22
North Carolina	15.13	14.28	18.34	14.14	14.30	14.30	14.61	14.18	14.98	15.86	15.06	15.21	15.85	15.41	16.68	17.06	16.25	16.87	16.49	16.[illegible]
Francis Marion Sumter	3.55	3.57	3.76	3.32	3.21	3.41	2.87	2.71	3.08	3.87	3.47	3.45	3.50	4.37	3.85	4.49	3.96	4.17	3.78	3.89
Texas	6.50	6.74	6.16	5.58	5.32	5.85	4.67	4.76	5.27	5.45	5.27	5.57	5.47	7.07	5.67	5.72	5.86	5.70	5.60	6.60
Jefferson	5.49	5.54	5.39	5.17	5.04	5.45	4.60	4.58	5.23	5.69	5.33	5.44	5.58	6.95	5.90	6.23	5.91	6.06	5.91	6.32
Caribbean	1.60	0.95	0.97	1.43	1.51	1.31	1.79	1.51	1.51	1.70	1.46	1.85	1.79	1.31	2.10	2.06	2.25	2.08	1.90	1.43
TOTAL	100.47	99.11	100.04	99.90	99.93	99.88	100.07	100.04	99.85	101.36	101.20	100.01	99.75	100.02	98.78	101.33	100.00	100.77	99.73	100.36

4. Model 4

Five indicators were used in Model 4. These factors seemed to represent use and capacity well. The percent of the Region's total was calculated for each indicator by Forest. Each indicator was given a weight factor. Weight factors were multiplied by the indicator percent. Weighted percents were totaled and divided by 10 (the total of weight factors).

5. Model 5

The same five indicators used in Model 4 were used in Model 5. Only the weight factors were changed. This was done to give a variety in weight factors. The percent of the Region's total was calculated for each indicator by Forest. Each indicator was given a weight factor. Weight factors were multiplied by the indicator percent. Weighted percents were totaled and divided by 14 (the total of weight factors).

6. Model 6

The same five indicators used in Models 4 and 5 were used in Model 6. No weight factors were assigned to the indicators. This represents a straight average. The percent of Region's total was calculated for each indicator by Forest. Percents were then totaled and divided by 5 (the number of indicators.

7. Model 7

Three indicators were used in Model 7. This was done to represent a small number of indicators. The percent of the Region's total was calculated for each indicator by Forest. Each indicator was given a weight factor. Weight factors were multiplied by the indicator percent. Weighted percents were totaled and divided by 9 (total of weight factors).

8. Model 8

The same three indicators used in Model 7 were used in Model 8. Only

the weight factors were changed. This was done to give a variety in weight factors. The percent of the Region's total was calculated for each indicator by Forest. Each indicator was given a weight factor. Weight factors were multiplied by the indicator percent. Weighted percent were totaled and divided by 7 (the total of the weight factors).

9. Model 9

The same three indicators used in Models 7 and 8 were used in Model 9. No weight factors were assigned to the indicators. This represents a straight average. The percent of Region's total was calculated for each indicator by Forest. Percents were then totaled and divided by 3 (The total number of indicators).

10. Model 10

Three indicators were used in Model 10. The percent of Region total was calculated for each indicator by Forest. Each indicator was given a weight factor. Weight factors were multiplied by indicator percent. Weighted percents were totaled and divided by 5 (The total of the weight factors).

Total cost use was calculated by dividing operational plus maintenance costs (by kind of site) by the number of RVD's (by kind of site) in the Region. The resulting Regional cost per RVD (by kind of site) was multiplied by the number of RVD's (by kind of site) for each unit. The results were totaled and divided by the total operational and maintenance costs for the Region.

Total cost capacity was calculated in the same manner as total cost use. Total costs (by kind of site) were divided by PAOT (by kind of site). The Regional costs per PAOT (by kind of site) were multiplied by PAOT (by kind of site). The results were totaled and divided by the Region operational and maintenance costs attributed to developed sites. There are no PAOT values assigned to dispersed sites. Total cost use and total cost capacity

represent a skewed use and capacity and were chosen for that reason.

11. Model 11

The same three indicators used in Model 10 were used in Model 11. No weight factors were assigned to the indicators. This represents a straight average. The percent of Region's total was calculated for each indicator by Forest. Percents were then totaled and divided by three (the number of indicators).

12. Model 12

Three indicators were used in Model 12. The percent of the Region's total was calculated for each indicator by Forest. Each indicator was given a weight factor. Weight factors were multiplied by indicator percent. Weighted percents were totaled and divided by five (the total of the weight factors). Operational cost use was calculated by dividing operation costs (by kind of site) by the number of RVD's (by kind of site) in the Region. The resulting Regional cost per RVD (by kind of site) was multiplied by the number of RVD's (by kind of site) for the subunit. The results were totaled and divided by the total operational costs for the Region.

Maintenance cost capacity was calculated in the same manner as operational cost use. Maintenance costs (by kind of site) were divided by PAOT Days (by kind of site). The Regional costs per PAOT Day were multiplied by PACT Days (by kind of site) for each subunit. The results were totaled and divided by the Region's maintenance costs attributed to developed sites. There are no PAOT Days assigned to dispersed sites.

13. Model 13

Six indicators were used in Model 13. The percent of Region total was calculated for each indicator by Forest. Each indicator was given a weight factor. Weight factors were multiplied by indicator percent. Weighted percents were totaled and divided by 8 (the total of the weight factors).

Operational cost use was calculated by dividing operational costs (by kind of site) by the number of RVD's (by kind of site) in the Region. The resulting Regional cost per RVD (by kind of site) was multiplied by the number of RVD's (by kind of site) for the subunit. The results were totaled and divided by the total operational costs for the Region.

Maintenance cost use was calculated by dividing maintenance costs (by kind of site) by the number of RVD's (by kind of site) in the Region. The resulting Regional cost per RVD (by kind of site) was multiplied by the number of RVD's (by kind of site) for the subunit. The results were totaled and divided by the total maintenance costs for the Region.

Operational cost capacity was calculated in the same manner as operational cost use. Operational costs (by kind of site) were divided by PAOT Days (by kind of site). The Regional costs per PAOT Day were multiplied by PAOT Days (by kind of site) for each subunit. The results were totaled and divided by the Region's operational costs attributed to developed sites. There are no PAOT Days assigned to dispersed sites.

Maintenance cost capacity was calculated in the same manner as operational cost use. Maintenance costs (by kind of site) were divided by PACT Days (by kind of site). The Regional costs per PAOT Day were multiplied by PAOT Days (by kind of site) for each subunit. The results were totaled and divided by the Region's maintenance costs attributed to developed sites. There are no PAOT Days assigned to dispersed sites.

14. Model 14

The RWL's for Model 14 were taken from the RIM Program. The contents of that program, the indicators, and weight factors are known only to the Recreation Staff in the Washington Office. The program outputs are RWL in percent for each National Forest in the system and provided by the W. O.

These systemwide percent RWL's were converted to Region RWL's by dividing the Forest percent of total by the Region percent.

15. Model 15

Four indicators were used in this model. The percent of the Region's total was calculated for each indicator. No weight factors were assigned to the indicators. Percents were totaled and divided by four (the number of indicators).

16. Model 16

Two indicators were used in Model 16. The percent of the Region's total was calculated for each indicator by Forest. No weights were assigned to the indicators. Percents were totaled and divided by two (the number of indicators).

17. Model 17

Two indicators were used in Model 17. The percent of Region total was calculated for each indicator by Forest. No weights were assigned to the indicators. Percents were totaled and divided by two (the number of indicators).

18. Model 18

Six indicators were used in Model 18. The percent of the Region's total was calculated for each indicator by Forest. Each indicator was assigned a weight factor. Weight factors were multiplied by indicator percents. Weighted percents were totaled and divided by eight (the total of the weight factors).

19. Model 19

Five indicators were used in Model 19. The percent of the Region's total

as calculated for each indicator by Forest. No weights were assigned to the indicators. Percents were totaled and divided by five (the number of indicators).

20. Model 20

Three indicators were used in Model 20. The percent of the Region's total was calculated for each indicator by Forest. No weights were assigned to indicators. Percents were totaled and divided by three (the number of indicators).

E. Model Comparison to Average

In order to evaluate the twenty models, each model was compared to the average RWL for all twenty models by Forest. A graphic presentation of this comparison is presented in Appendix E.

The RWL for each model was plotted on a graph for each forest. The average of all twenty models was then plotted on the graph as a straight line. A plus and minus five percent of the average were also plotted on the graph as straight lines.

Any model which plotted within the plus and minus five percent lines is shown by a circle on the graph.

The number of occurrences by model is summarized in the following table.

TABLE 2

Model Number	Number of Occurrences
1	7
2	6
3	6
4	4
5	3
6	9

TABLE 2 (con'd)

MODEL NUMBER	NUMBER OF OCCURRENCES
7	3
8	2
9	5
10	8
11	7
12	8
13	12
14	3
15	8
16	4
17	6
18	7
19	9
20	1

The purpose of this comparison and analysis was to eliminate those models showing the largest deviance from the average.

The only evaluation criterion which could be readily applied to each model was consistency. Consistency was measured by the deviation or variance from the average.

F. Model Selection

Only those models which had eight or more occurrences were selected for further analysis. Six models fit this parameter : Models 6, 10, 12, 13, 15 and 19.

G. Deviation From the Average

Total deviation was computed for each of the six models by adding the deviation for each Forest. Average deviation for each model was computed by dividing the total deviation by 15 (the number of subunits). No difference was made between plus or minus deviations.

Individual deviations by model and Forest are shown in Appendix F. The table following summarizes the results.

TABLE 3

MODEL	TOTAL DEVIATION %	AVERAGE DEVIATION %
6	76.39	5.09
10	65.74	4.38
12	87.48	5.83
13	47.61	3.17
15	104.94	7.00
19	102.35	6.82

IV. CONCLUSIONS

The results of computing the total deviation and average deviation from the average RWL for the final six models shows that Model 13 is the most consistent. This model averaged only 3.17 percent deviation, either plus or minus, for each of the 15 National Forests in Region 8.

Total deviation from the average RWL of all twenty models was only 47.61 percent for Model 13. Over 24 percent of the total deviation for Model 13 was attributable to the Caribbean National Forest. The Caribbean accounts for less than 2 percent of the RWL in Region 8.

Since the only evaluation criteria for the 20 models was consistency and Model 13 was the most consistent, it was selected as the model which will be used on the Cherokee National Forest to establish the RWL of each District.

V. OBSERVATIONS

A study of each indicator compared to the Model 13 RWL by forest revealed that PAOT Days was the most consistent indicator. This is significant since PAOT Days are used to assign targets in Region 8.

Total deviation from the average for all twenty models was greatest for those forests with an average RWL of 8.5 and up. Those forests with an average RWL of 4.0 to 8.4 had a medium total deviation. Those forests with an average RWL of less than 4.0 had the smallest total deviation.

This suggests that as the RWL increases, so does the complexity of the work and the difficulty in measuring the RWL.

The value of using RWL could be very high when dealing with constrained budgets. For example, in preparing the FY 85 budget, the Forest Supervisor of the Cherokee National Forest, might want to know just how much emphasis he should place on recreation. One way to do this would be to compare the FY 82 RWL and budget to the various constrained levels.

In FY 82 the Cherokee received 5.51 percent of the recreation budget dispersed to forests. This amounted to $475,000. The RWL for the Cherokee in FY 82 was 8.446. This means that the Cherokee accomplished 8.446 percent of the recreation workload with 5.51 percent of the funds. Had the Cherokee placed more emphasis on recreation when requesting the FY 82 budget, it could have requested an amount equal to its RWL. That amount would have been $728,000, an increase of $253,000 (over 53 percent).

The $475,000 FY 82 budget amounted to 25.8 percent of the P & M total for the Cherokee, $728,000 would have been 39.5 percent of the P & M total. While preparing the FY 85 budget, the supervisor will know that approximately 40 percent of his P & M budget should be in recreation management in order to keep RWL and percent of funding in line.

While RWL can be used as an aid in budgeting, it cannot help the manager decide which type of sites should be funded, or which type of sites should be closed in times of reduced budgets. A linear program could be developed using the indicators in Model 13. They were operational cost use, maintenance cost use, operational cost capacity, maintenance cost capacity, total fees and total costs.

While all calculations performed in preparing this project were done by hand, a relatively simple program will be developed to calculate the Model 13 RWL. A program will be developed by the Cherokee prior to implementing Model 13 for use in preparing the FY 84 Forest Budget.

A relatively simple calculation can indicate the level of demand on an individual site or unit. PAOT Days for the site or unit can be divided by (RVD x 2) for that site or unit. The closer the result is to 1.0, the greater the use and to some extent demand, for that site or unit.

APPENDIX A

Possible Indicators

1. Developed Area Use : RVD's
2. Dispersed Area Use : RVD's
3. Total Use : RVD's
4. Developed Area: Acres
5. Wilderness Use : RVD's
6. Wilderness Area : Acres
7. Dispersed Area : Acres
8. Daily Use Fees : Dollars
9. Special Use Fees : Dollars
10. Total Fees: Dollars
11. Scenic Area or Special Areas Use: RVD's
12. Scenic Area: Acres
13. FY 82 Recreation Budget: Dollars
14. Citations Issued : Number
15. Fee Area Capacity : PAOT
16. Non-Fee Area Capacity : PAOT
17. Total Capacity : PAOT
18. Fee Area : Acres
19. Non-Fee Area : Acres
20. Total Operations Cost : Dollars
21. Total Maintenance Cost : Dollars
22. Operation Cost by Type of Site: Dollars
23. Maintenance Cost by Type of Site: Dollars
24. Capacity x Days : PAOT Days
25. Fee Capacity x Days: PAOT Days
26. Non-Fee Capacity Days : PAOT Days
27. % Capacity : PAOT Days ÷ (RVDs x 2)
28. Special Use Capacity: PAOT
29. Special Use Capacity x Days : PAOT Days
30. Special Use Use : RVDs
31. Operational Cost Use: Dollars ÷ RVD
32. Maintenance Cost Use: Dollars ÷ RVD
33. Total Cost Use: Dollars ÷ RVD
34. Operation Cost Capacity : Dollars ÷ PAOT Days
35. Maintenance Cost Capacity: Dollars ÷ PAOT Days
36. Total Cost Capacity : Dollars ÷ PAOT
37. Visitation : Number of visits

APPENDIX D

SOURCES OF DATA FOR SELECTED INDICATORS

Indicator	Source of Data	Date of Data
Developed Use	RIM Special #39	11/18/82
Dispersed Use	RIM Special #39	11/18/82
Wilderness Use	"Use of National Forest Units of National Wilderness Preservation System FY 82"	1982
Total Fees	"Annual Collection Statement National Forest Fund, KV and Purchaser Credit Earnings" Region 8, FY 82	12/6/82
Fee PAOT	Recreation Facts USDA, Forest Service, Southern Region Pg. 13	1982
Non Fee PAOT	RIM Special #18	4/20/82
Number Fee Areas	Recreation Facts, USDA, Forest Service, Southern Region	1982
Number Non-Fee Areas		
Operational Costs	RIM 2300-6A	7/15/82
Maintenance Costs	RIM 2300-6A	7/15/82
Total PAOT	RIM Special #18	4/20/82
Total Costs	RIM 2300-6A	7/15/82
Total Use	RIM Special #39	11/18/82
Operational Cost Use	RIM Special #39 &	11/18/82
	RIM 2300-6A	7/15/82
Maintenance Cost Use	RIM Special #39 &	11/18/82
	RIM 2300-62	7/15/82
Operational Cost Capacity	RIM Special #18 &	4/20/82
	RIM 2300-6A	7/15/82
Maintenance Cost Capacity	RIM Special #18 &	4/20/82
	RIM 2300-6A	7/15/82
Total Cost Use	RIM Special #39 &	11/18/82
	RIM 2300-6A	7/15/82
Total Cost Capacity	RIM Special #18 &	4/20/82
	RIM 2300-6A	7/15/82
PAOT Days	RIM Special #18	4/20/82

APPENDIX C

SELECTED INDICATORS AND DEFINITIONS

1. Developed Use

Data are readily available from RIM documents. It is the only measurement of use in developed recreation areas. Use should give a good indication of total recreation workload.

2. Dispersed Use

Data are readily available from RIM documents. It is the only measurement of use on National Forests outside of developed areas. While not a very good indicator of total workload, it will compliment developed use and is required to calculate total use.

3. Wilderness Use

Data are readily available from an annual report. It compliments dispersed and developed use.

4. Total Fees

Fees are only collected on approved highly developed areas and special uses. Representative of the workload is highly developed areas by indicating the level of use. Data are readily available from an annual report.

5. Fee PAOT

Data are readily available from RIM documents. A good measurement of the capacity of highly developed areas.

6. Non Fee PAOT

Data are readily available from RIM documents. A good measurement of capacity in less highly developed areas.

7. Number of Fee Areas

Data are readily available from annual reports. Give a fair indication of the level of development of a subunit.

8. Operational Costs

Data are readily available from RIM documents. An excellent indicator of workload. It should represent the total cost required to operate developed and dispersed recreation areas.

9. Maintenance Costs

Data are readily available from RIM documents. A good measurement of annual maintenance costs of areas.

10. Total PAOT

A combination of indicators #5 & #6. Gives a good overall measurement of developed capacity.

11. Total Costs

A combination of indicators #8 & #9. A good measurement of annual costs involved in the management of developed and dispersed areas.

12. Total Use

A combination of indicators #1 & #2. Represents the total level of use of a subunit. May be degraded in value as an indicator by estimating use.

13. Operational Cost Use

Values available from computations with data readily available from RIM documents. An excellent indicator of workload. Measures use , site and cost of operation per RVD by site.

14. Maintenance Cost Use

Same as operational cost use, but measures maintenance cost per PVD by kind of site.

15. Operational Cost Capacity

Same as operational cost use except measures costs by site per PAOT Day.

16. Maintenance Cost Capacity

Same as maintenance cost use except measures costs by site per PAOT Day.

17. Total Cost Use

A combination of indicators # 13 & #14.

18. Total Cost Capacity

A combination of indicators #15 & #16.

19. PAOT Days

Data are readily available. A better measurement of capacity than PAOT.

APPENDIX D

MATHEMATICAL FORMULAS
MODEL 1

The formula is: $\sum_{n}^{1} ((I_n + R_n)(F_n))/26$

WHERE:

$n = 10$

I_1 = Sub-Unit RVD (developed use)

R_1 = Region RVD (developed use)

$F_1 = 5$

I_2 = Sub-unit RVD (dispersed use)

R_2 = Region RVD (dispersed use)

$F_2 = 1$

I_3 = Sub-unit RVD (Wilderness use)

R_3 = Region RVD (Wilderness use)

$F_3 = 1$

I_4 = Sub-unit Dollars (Total Fees)

R_4 = Region Dollars (Total Fees)

$F_4 = 3$

I_5 = Sub-unit PAOT (Capacity, Fee Areas)

R_5 = Region PAOT (Capacity, Fee Areas)

$F_5 = 3$

I_6 = Sub-unit PAOT (Capacity, Non-Fee Areas)

R_6 = Region PAOT (Capacity, Fee Areas)

$F_6 = 2$

I_7 = Sub-unit number (Fee Areas)

R_7 = Region number (Fee Areas)

$F_7 = 3$

I_8 = Sub-unit number (Non-Fee Areas)

R_8 = Region number (Non-Fee Areas)

F_7 = 2

I_9 = Sub-unit Dollars (Operational Costs)

R9 = Region Dollars (Operational Costs)

F_9 = 4

I_{10}= Sub-unit Dollars (Maintenance Costs)

R_{10}= Region Dollars (Maintenance Costs)

F_{10}= 2

MODEL 2

The formula is: $\Sigma_n^1 (\{I_n + R_n\}\{F_n\})/23$

WHERE:

n = 10

I_1 = Sub-unit RVD (developed use)

R_1 = Region RVD (developed use)

F_1 = 3

I_2 = Sub-unit RVD (dispersed use)

R_2 = Region RVD (dispersed use)

F_2 = 1

I_3 = Sub-unit RVD (Wilderness use)

R_3 = Region RVD (Wilderness use)

F_3 = 1

I_4 = Sub-unit Dollars (Total Fees)

R_4 = Region Dollars (Total Fees)

F_4 = 3

I_5 = Sub-unit PAOT (Capacity, Fee Areas)

R_5 = Region PAOT (Capacity, Fee Areas)

F_5 = 3

I_6 = Sub-unit PAOT (Capacity, Non-Free Areas)

R_6 = Region PAOT (Capacity, Non-Free Areas)

F_6 = 2

I_7 = Sub-unit number (Fee Areas)

R_7 = Region number (Fee Areas)

F_7 = 3

I_8 = Sub-unit number (Non-Fee Areas)

R_8 = Region number (Non-Fee Areas)

F_7 = 2

I_9 = Sub-unit Dollars (Operational Costs)

R_9 = Region Dollars (Operational Costs)

F_9 = 3

I_{10} = Sub-unit Dollars (Maintenance Costs)

R_{10} = Region Dollars (Maintenance Costs)

F_{10} = 2

MODEL 3

The formula is: $\Sigma_{\eta}^{1} (\{I_{\eta} : R_{\eta}\}\{F_{\eta}\})/10$

WHERE:

n = 10

I_1 = Sub-unit RVD (developed use)

R_1 = Region RVD (developed use)

I_2 = Sub-unit RVD (dispersed use)

R_2 = Region RVD (dispersed use)

I_3 = Sub-unit RVD (Wilderness use)

R_3 = Region RVD (Wilderness use)

I_4 = Sub-unit Dollars (Total Fees)

R_4 = Region Dollars (Total Fees)

I_5 = Sub-unit PAOT (Capacity, Fee Areas)

R_5 = Region PAOT (Capacity, Fee Areas)

I_6 = Sub-unit PAOT (Capacity, Non-Fee Areas)

R_6 = Region PAOT (Capacity, Non-Fee Areas)

I_7 = Sub-unit number (Fee Areas)

R_7 = Region number (Fee Areas)

I_8 = Sub-unit number (Non-Fee Areas)

R_8 = Region number (Non-Fee Areas)

I_9 = Sub-unit Dollars (Operational Costs)

R_9 = Region Dollars (Operational Costs)

I_{10} = Sub-unit Dollars (Maintenance Costs)

R_{10} = Region Dollars (Maintenance Costs)

MODEL 4

The formula is: $\Sigma_{\eta}^{1} (\{I_{\eta} : R_{\eta}\}\{F_{\eta}\})/10$

WHERE:

n = 3

I_1 = Sub-unit RVD (Developed use)

R_1 = Region RVD (Developed use)

F_1 = 3

I_2 = Sub-unit RVD (dispersed use)

R_2 = Region RVD (dispersed use)

F_2 = 1

I_3 = Sub-unit Dollars (Total Fees)

R_3 = Region Dollars (Total Fees)

F_3 = 2

MODEL 5

The formula is: $\sum_{n}^{1}(\{I_n + R_n)(F_n\})/14$

WHERE:

n = 5

I_1 = Sub-unit RVD (developed use)

R_1 = Region RVD (developed use)

F_1 = 5

I_2 = Subunit RVD (dispersed use)

R_2 = Region RVD (dispersed use)

F_2 = 1

I_3 = Sub-unit Dollars (total fees)

R_3 = Region Dollars (total fees)

F_3 = 3

I_4 = Sub-unit PAOT (Capacity)

R_4 = Region PAOT (Capacity)

F_4 = 2

I_5 = Sub-unit Dollars (Total Cost)

R_5 = Region Dollars (Total Cost)

F_5 = 3

MODEL 6

The formula is: $\Sigma_{\eta}^{1} (I_{\eta} - R_{\eta})/5$

WHERE:

$n = 5$

I_1 = Sub-unit RVD (developed use)

R_1 = Region RVD (developed use)

I_2 = Sub-unit RVD (dispersed use)

R_2 = Region RVD (dispersed use)

I_3 = Sub-unit Dollars (Total fees)

R_3 = Region Dollars (Total Fees)

I_4 = Sub-unit PAOT (Capacity)

R_4 = Region PAOT (Capacity)

I_5 = Sub-unit Dollars (total cost)

R_5 = Region Dollars (total cost)

The formula is: $\Sigma_{\eta}^{1} (\{I_{\eta} + R_{\eta}\} \{F_{\eta}\})/9$ MODEL 7

WHERE:

$n = 3$

I_1 = Sub-unit RVD (developed use)

R_1 = Region RVD (developed use)

$F_1 = 5$

I_2 = Sub-unit RVD (dispersed use)

R_2 = Region RVD (dispersed use)

$F_2 = 1$

I_3 = Sub-unit Dollars (total fees)

R_3 = Region Dollars (total fees)

$F_3 = 3$

MODEL 8

The formula is: $\Sigma_{n}^{1} ((I_n + R_n)(F_n))/7$

WHERE:

$n = 3$

I_1 = Sub-unit RVD (developed use)

R_1 = Region RVD (developed use)

$F_1 = 3$

I_2 = Sub-unit RVD (dispersed use)

R_2 = Region RVD (dispersed use)

$F_2 = 1$

I_3 = Sub-unit Dollars (total fees)

R_3 = Region Dollars (total fees)

$F_3 = 3$

MODEL 9

The formula is: $\Sigma_{n}^{1} (I_n + R_n)/3$

WHERE:

$n = 3$

I_1 = Sub-unit RVD (developed use)

R_1 = Region RVD (developed use)

I_2 = Sub-unit RVD (dispersed use)

R_2 = Region RVD (dispersed use)

I_3 = Sub-unit Dollars (total fees)

R_3 = Region Dollars (total fees)

MODEL 10

The formula is: $\Sigma_{\eta}^{1} (\{I_{\eta} + R_{\eta}\}\{F_{\eta}\})/5$

WHERE:

$n = 3$

I_1 = Sub-unit Dollars (total cost use)

R_1 = Region Dollars (total cost use)

$F_1 = 2$

I_2 = Sub-unit Dollars (total cost capacity)

R_2 = Region Dollars (total cost capacity)

$F_2 = 2$

I_3 = Sub-unit Dollars (total fees)

R_3 = Region Dollars (total fees)

$F_3 = 1$

MODEL 11

The formula is: $\Sigma_{\eta}^{1} (I_{\eta} + R_{\eta})/3$

WHERE:

$n = 3$

I_1 = Sub-unit Dollars (total cost use)

R_1 = Region Dollars (total cost use)

I_2 = Sub-unit Dollars (total cost capacity)

R_2 = Region Dollars (total cost capacity)

I_3 = Sub-unit Dollars (total fees)

R_3 = Region Dollars (total fees)

MODEL 12

The formula is: $\Sigma_{n}^{1} (\{I_n + R_n\} \{F_n\})/5$

WHERE:

$n = 3$

I_1 = Sub-unit Dollars (Operational Cost Use)

R_1 = Region Dollars (Operational Cost Use)

$F_1 = 2$

I_2 = Sub-unit Dollars (Maintenance Cost Capacity)

R_2 = Region Dollars (Maintenance Cost Capacity)

$F_2 = 2$

I_3 = Sub-unit Dollars (total fees)

R_3 = Region Dollars (total fees)

$F_3 = 1$

MODEL 13

The formula is: $\Sigma_{n}^{1} (\{I_n + R_n\} \{F_n\})/8$

WHERE:

$n = 6$

I_1 = Sub-unit Dollars (Operational Cost Use)

R_1 = Region Dollars (Operational Cost Use)

$F_1 = 2$

I_2 = Sub-unit Dollars (Maintenance Cost Use)

R_2 = Region Dollars (Maintenance Cost Use)

$F_2 = 1$

I_3 = Sub-unit Dollars (Operational Cost Capacity)

R_3 = Region Dollars (Operational Cost Capacity)

$F_3 = 2$

MODEL 13 (con't)

I_4 = Sub-unit Dollars (Maintenance Cost Capacity)

R_4 = Region Dollars (Maintenance Cost Capacity)

F_4 = 1

I_5 = Sub-unit Dollars (total fees)

R_5 = Region Dollars (total fees)

F_5 = 1

I_6 = Sub-unit Dollars (total costs)

R_6 = Region Dollars (total costs)

F_6 = 1

MODEL 14

The formula is : $I_1 \div R_1$

Where: I_1 = Sub-unit System RWL

R_1 = Region System RWL

MODEL 15

The formula is: $\Sigma_n^1 (I_n \div R_n)/4$

Where: n = 4

I_1 = Sub-unit Dollars (Operation Cost Use)

R_1 = Region Dollars (Operational Cost Use)

I_2 = Sub-unit Dollars (Maintenance Cost Use)

R_2 = Region Dollars (Maintenance Cost Use)

I_3 = Sub-unit Dollars (Operational Cost Capacity)

R_3 = Region Dollars (Operational Cost Capacity)

I_4 = Sub-unit Dollars (Maintenance Cost Capacity)

R_4 = Region Dollars (Maintenance Cost Capacity)

MODEL 16

The formula is: $\left[(I_1 \div R_1) + (I_2 \div R_2)\right] \div 2$

Where:

I_1 = Sub-unit Dollars (total cost use)

R_1 = Region Dollars (total cost use)

I_2 = Sub-unit Dollars (total cost capacity)

R_2 = Region Dollars (total cost capacity)

MODEL 17

The formula is: $\left[(I_1 \div R_1) + (I_2 \div R_2)\right] \div 2$

Where:

I_1 = Sub-unit Dollars (Operational Cost Use)

R_1 = Region Dollars (Operational Cost Use)

I_2 = Sub-unit Dollars (Maintenance Cost Capacity)

R_2 = Region Dollars (Maintenance Cost Capacity)

MODEL 18

The formula is: $\Sigma_{\eta}^{1} (\{I_\eta \div R_\eta\} \{F_\eta\})/6$

Where:

$n = 6$

I_1 = Sub-unit Dollars (Operational Cost Use)

R_1 = Region Dollars (Operational Cost Use)

$F_1 = 1$

I_2 = Sub-unit Dollars (Maintenance Cost Use)

R_2 = Region Dollars (Maintenance Cost Use)

$F_2 = 1$

I_3 = Sub-unit Dollars (Operational Cost Capacity)

R_3 = Region Dollars (Operational Cost Capacity)

I_4 = Sub-unit Dollars (Maintenance Cost Capacity)

R_4 = Region Dollars (Maintenance Cost Capacity)

MODEL 18 (con't)

$F_4 = 1$

I_5 = Sub-unit Dollars (Total Cost Use)

R_5 = Region Dollars (Total Cost Use)

$F_5 = 2$

I_6 = Sub-unit Dollars (total cost capacity)

R_6 = Region Dollars (total cost capacity)

$F_6 = 2$

MODEL 19

The formula is: $\Sigma_{\eta}^{1} (I_{\eta} + R_{\eta})/5$

Where:

$n = 5$

I_1 = Sub-unit Dollars (Operational Cost Use)

R_1 = Region Dollars (Operational Cost Use)

I_2 = Sub-unit Dollars (Maintenance Cost Use)

R_2 = Region Dollars (Maintenance Cost Use)

I_3 = Sub-unit Dollars (Operational Cost Capacity

R_3 = Region Dollars (Operational Cost Capacity)

I_4 = Sub-unit Dollars (Maintenance Cost Capacity)

R_4 = Region Dollars (Maintenance Cost Capacity)

I_5 = Sub-unit Dollars (total costs)

R_5 = Region Dollars (total costs)

MODEL 20

The formula is: $\Sigma_{\eta}^{1} (I_{\eta} + R_{\eta})/3$

Where:

$n = 3$

I_1 = Sub-unit PAOT Days (capacity)

R_1 = Region PAOT Days (Capacity)

I_2 = Sub-unit Dollars (total cost)

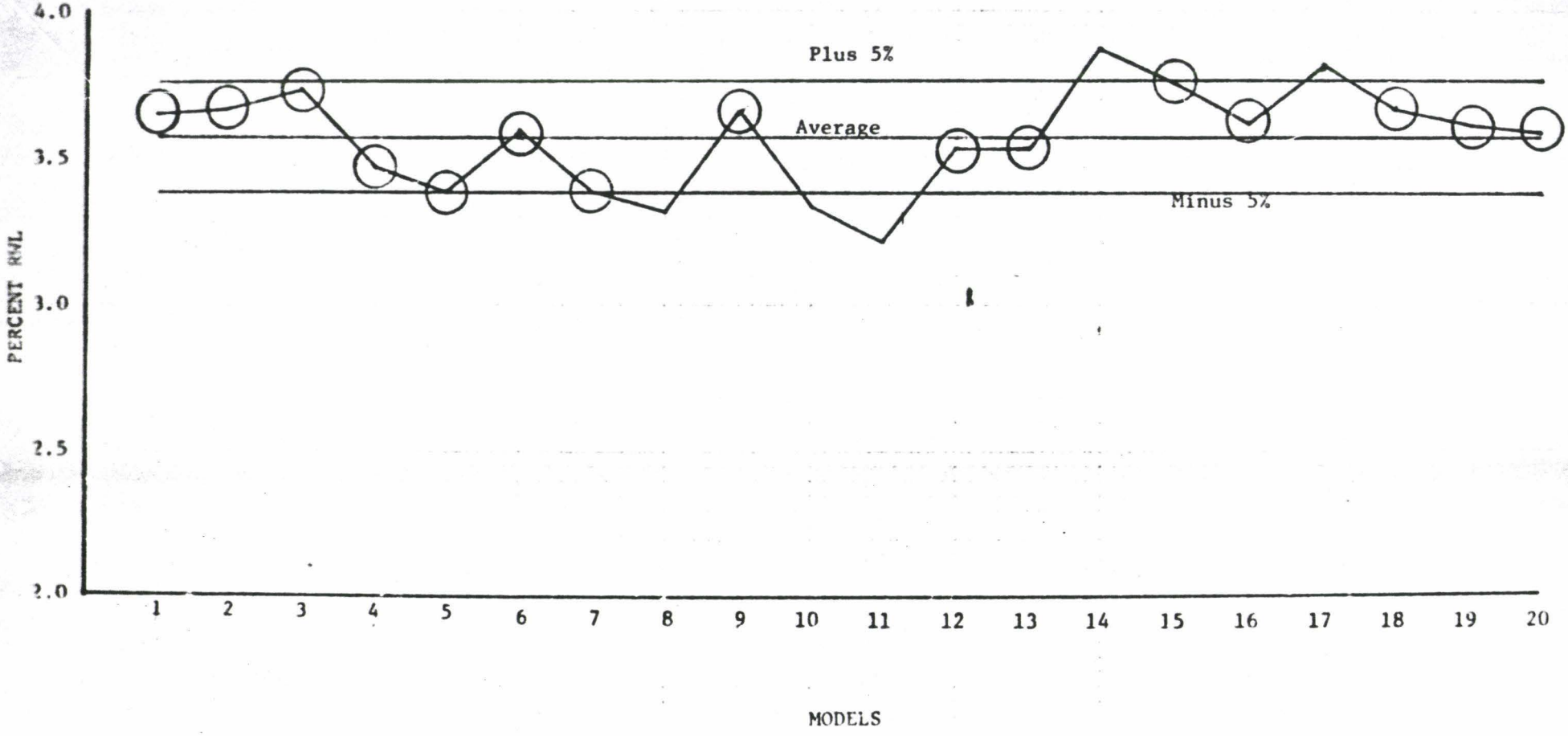
R_2 = Region Dollars (total cost)

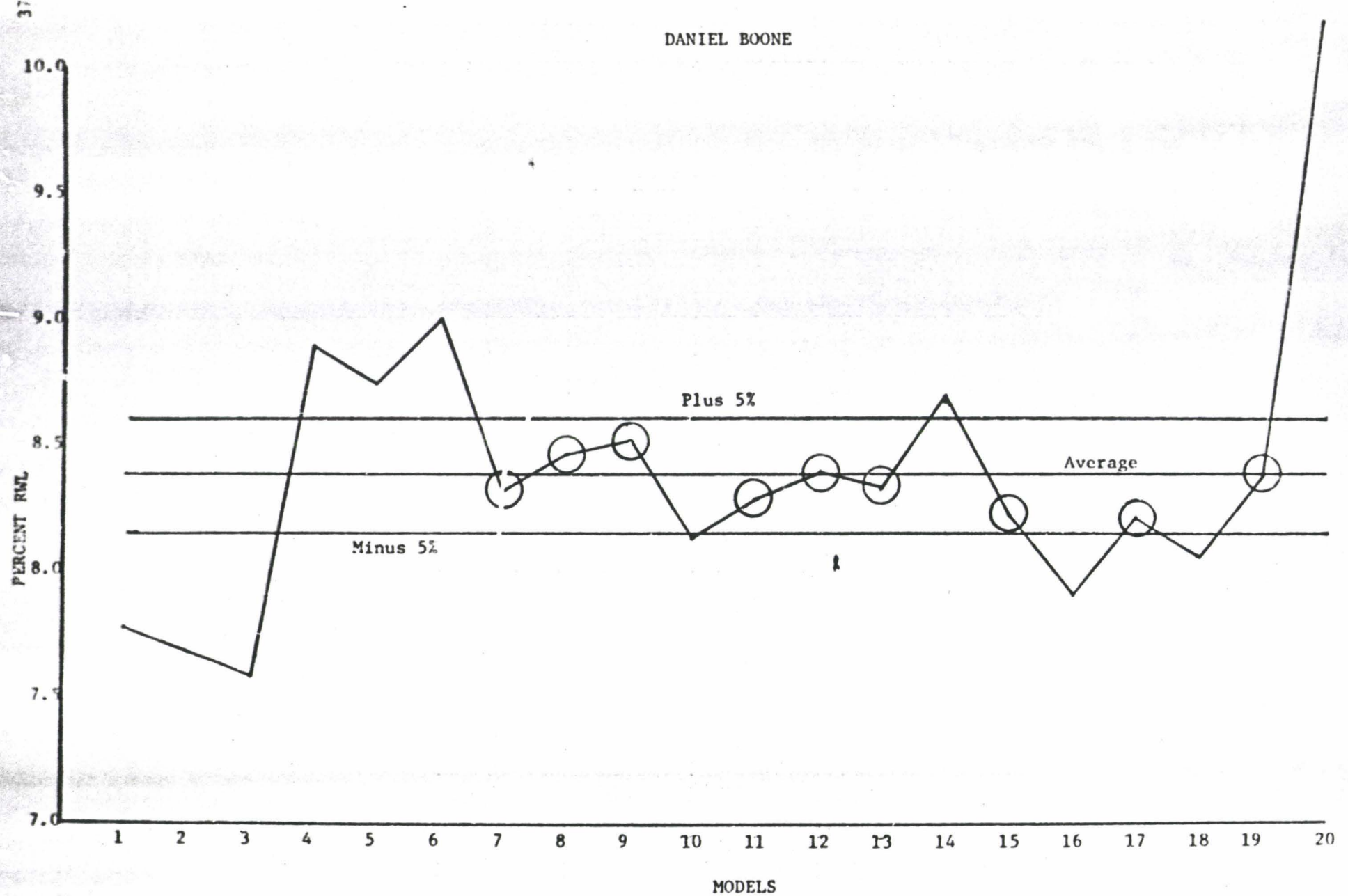
I_3 = Sub-unit RVD (total use)

R_3 = Region RVD (total use)

APPENDIX E

ALABAMA




DANIEL BOONE
10.0
9.5
9.0
8.5
8.0
7.5
7.0
PERCENT RWL
Plus 5%
Average
Minus 5%
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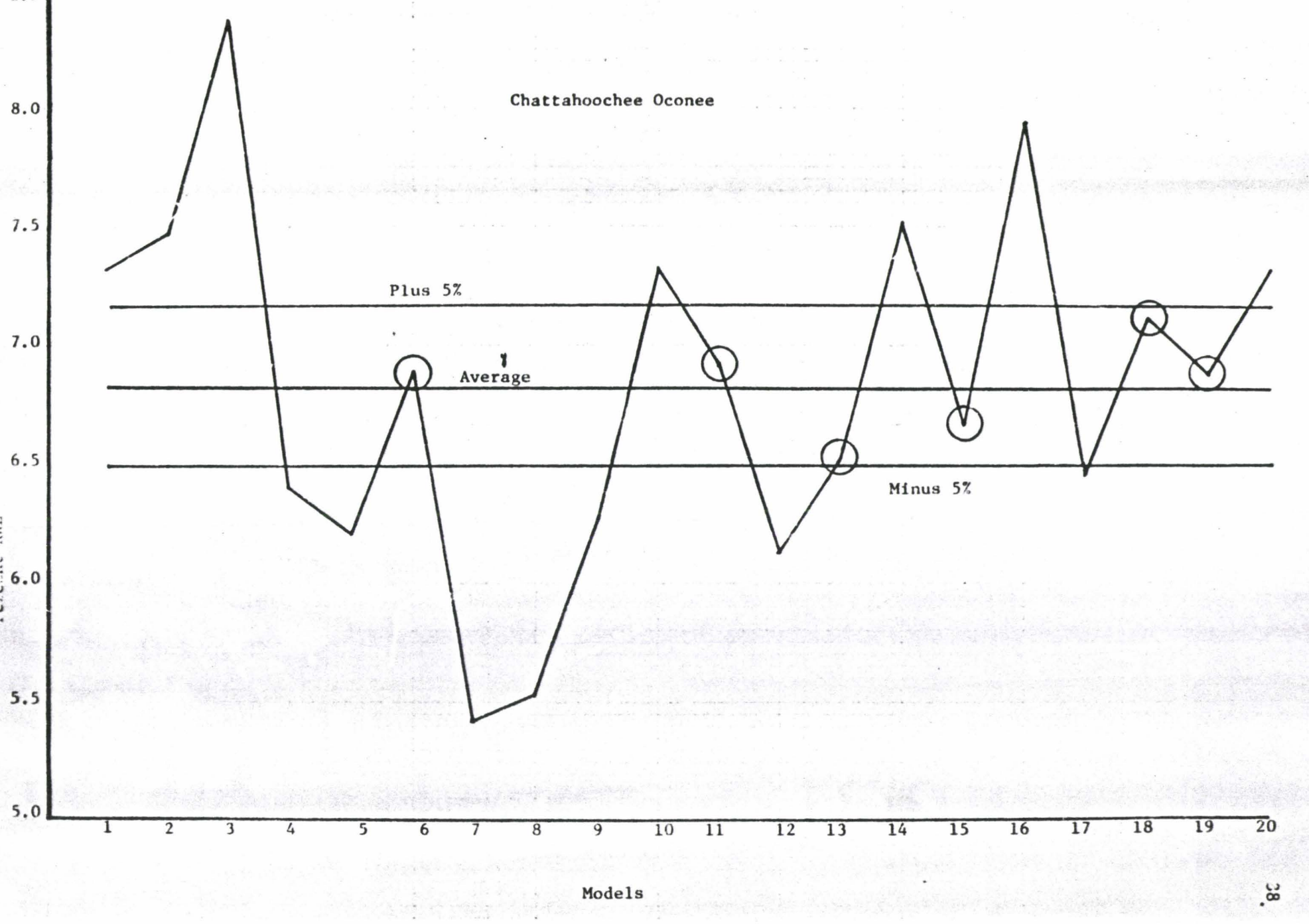
19
20
MODELS


Chattahoochee Oconee
8.0
7.5
7.0
6.5
6.0
5.5
5.0
Plus 5%
Average
Minus 5%
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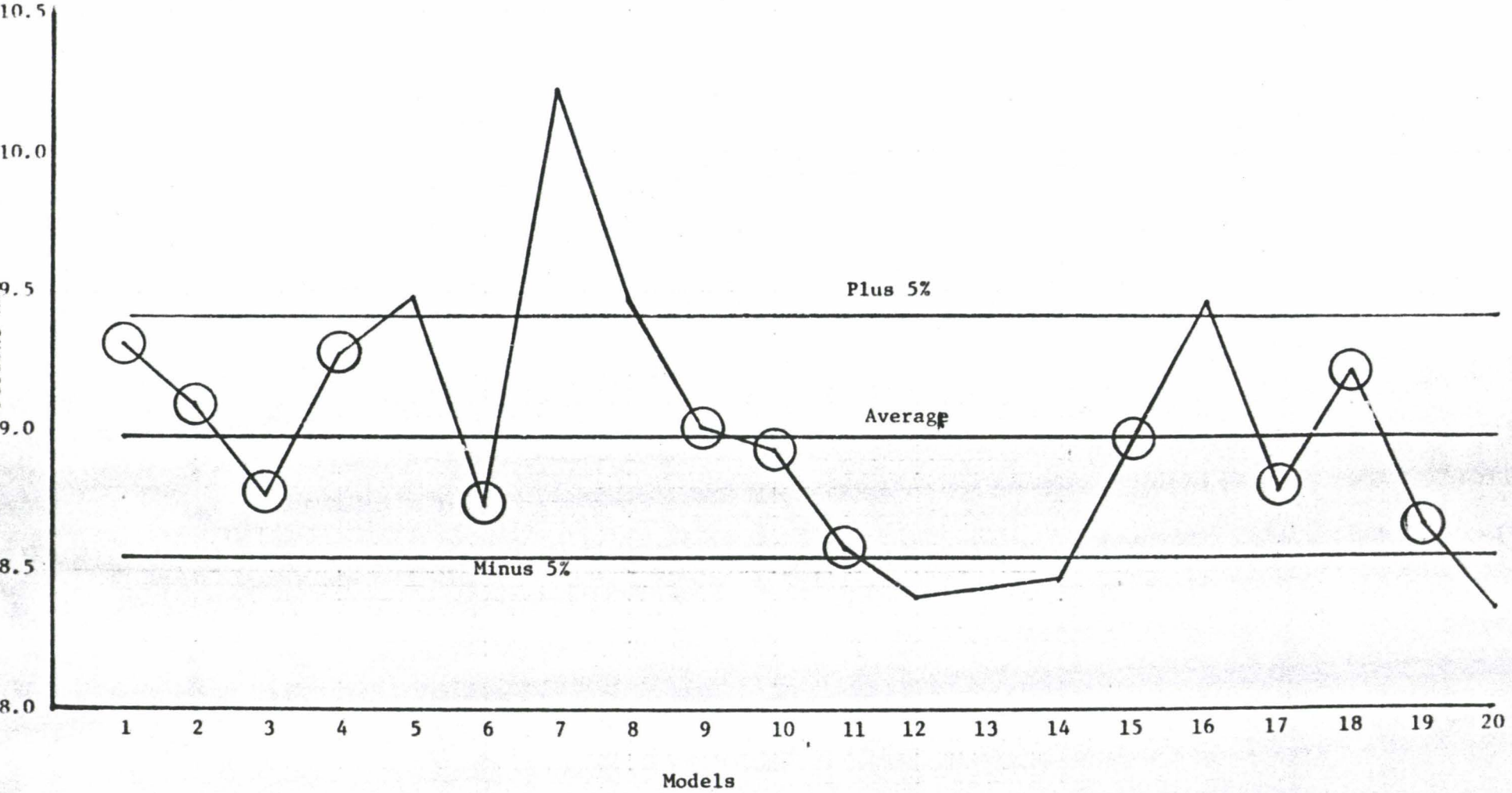
Models

Cherokee


10.5
10.0
9.5
9.0
8.5
8.0
Plus 5%
Average
Minus 5%
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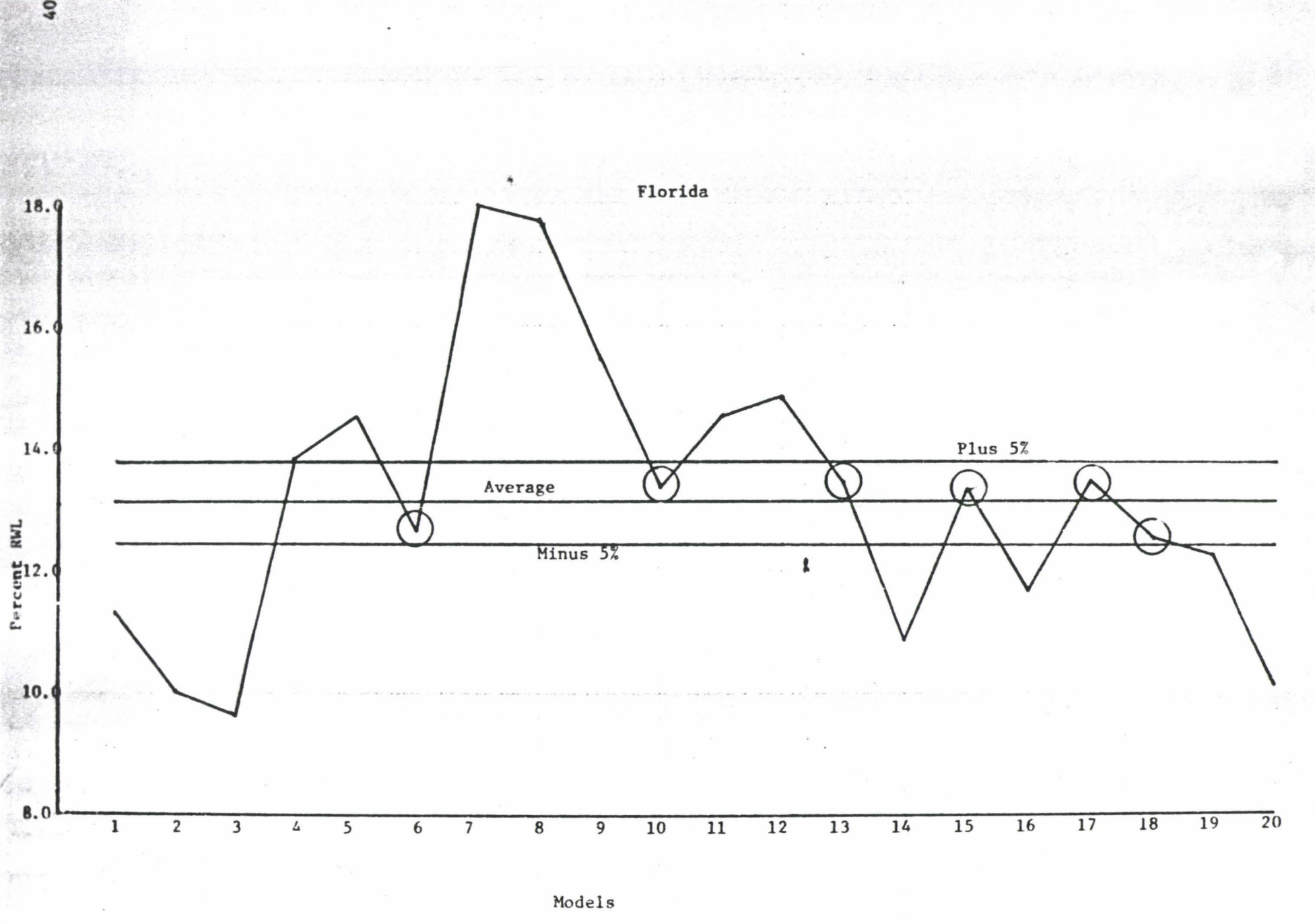
Models


Florida
18.0
16.0
14.0
12.0
10.0
8.0
Percent RWL
Plus 5%
Average
Minus 5%
1
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9
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14
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16
17
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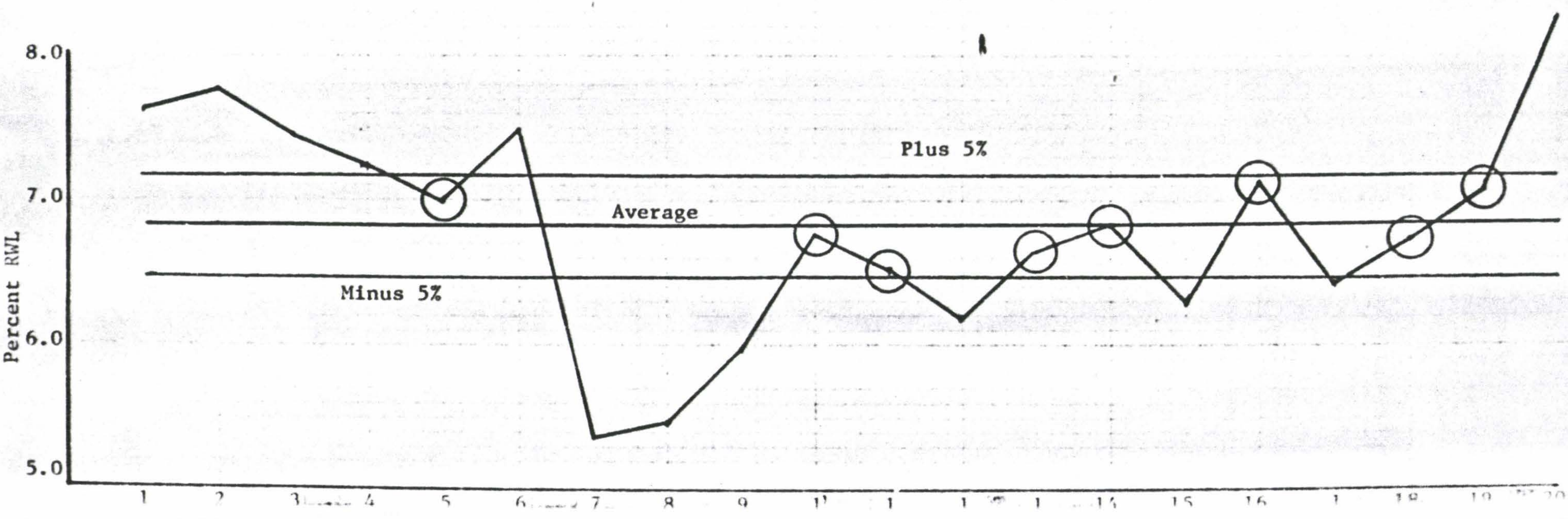
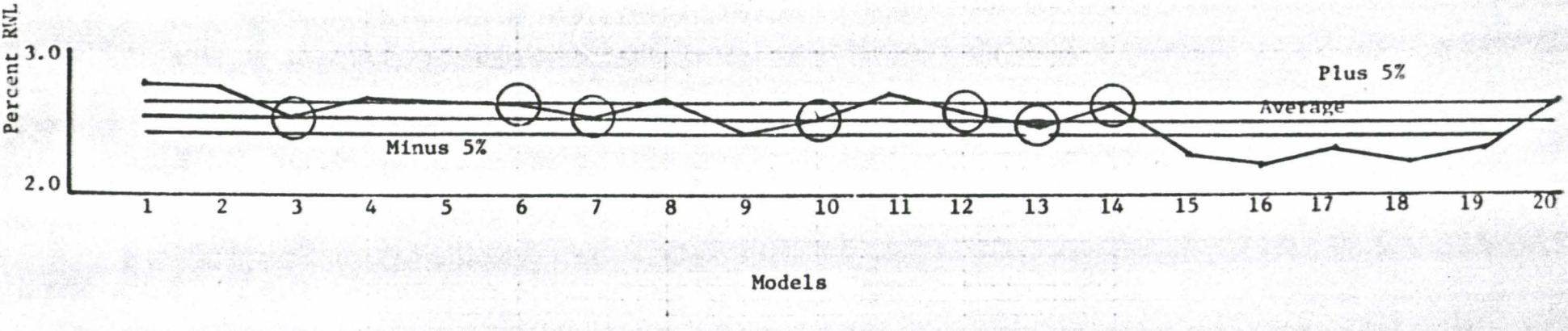
19
20
Models

George Washington



Kisatchie


Percent RNL
3.0
2.0
Plus 5%
Average
Minus 5%
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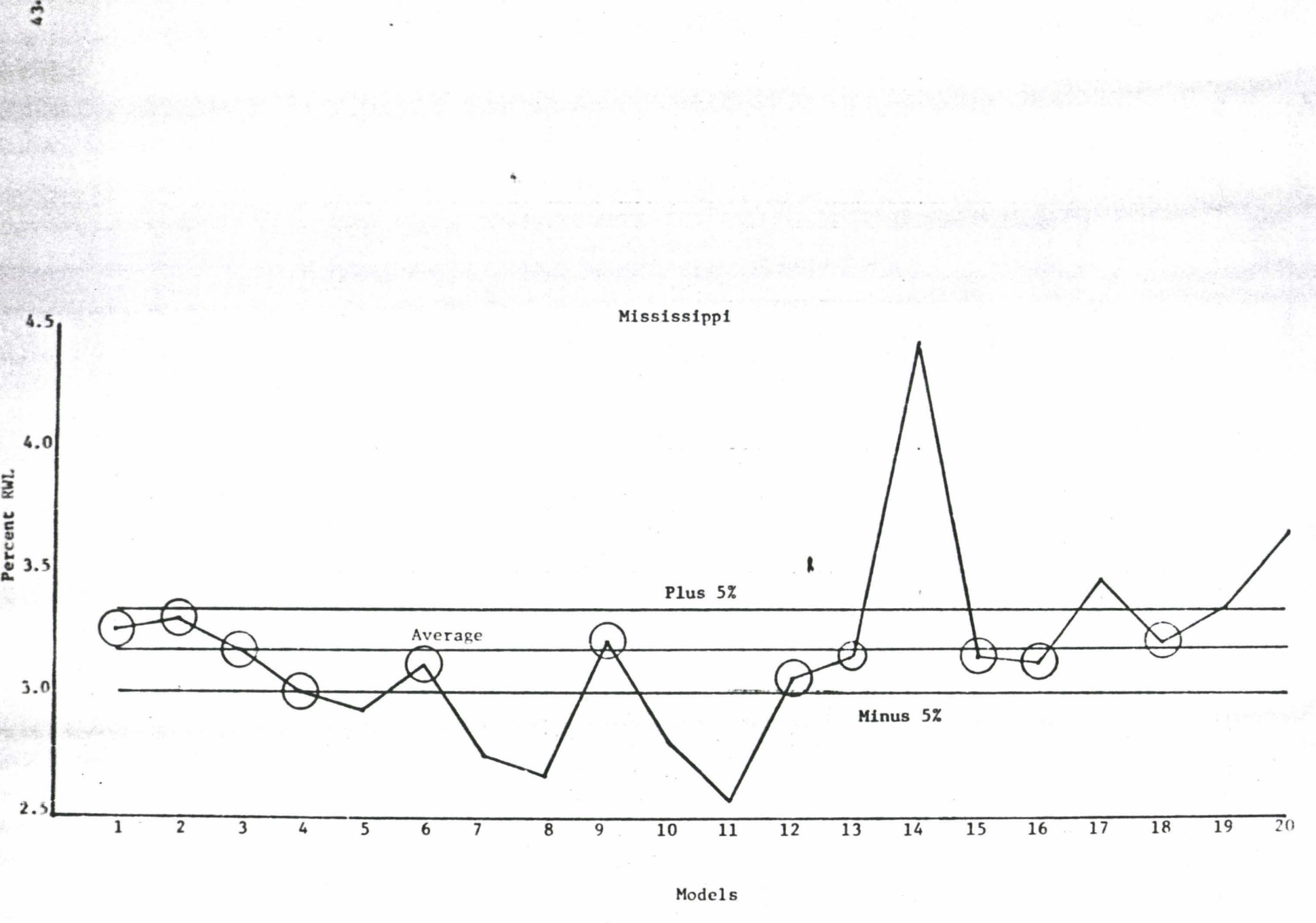
20
Models


Mississippi
4.5
4.0
3.5
3.0
2.5
Percent RWL
Plus 5%
Average
Minus 5%
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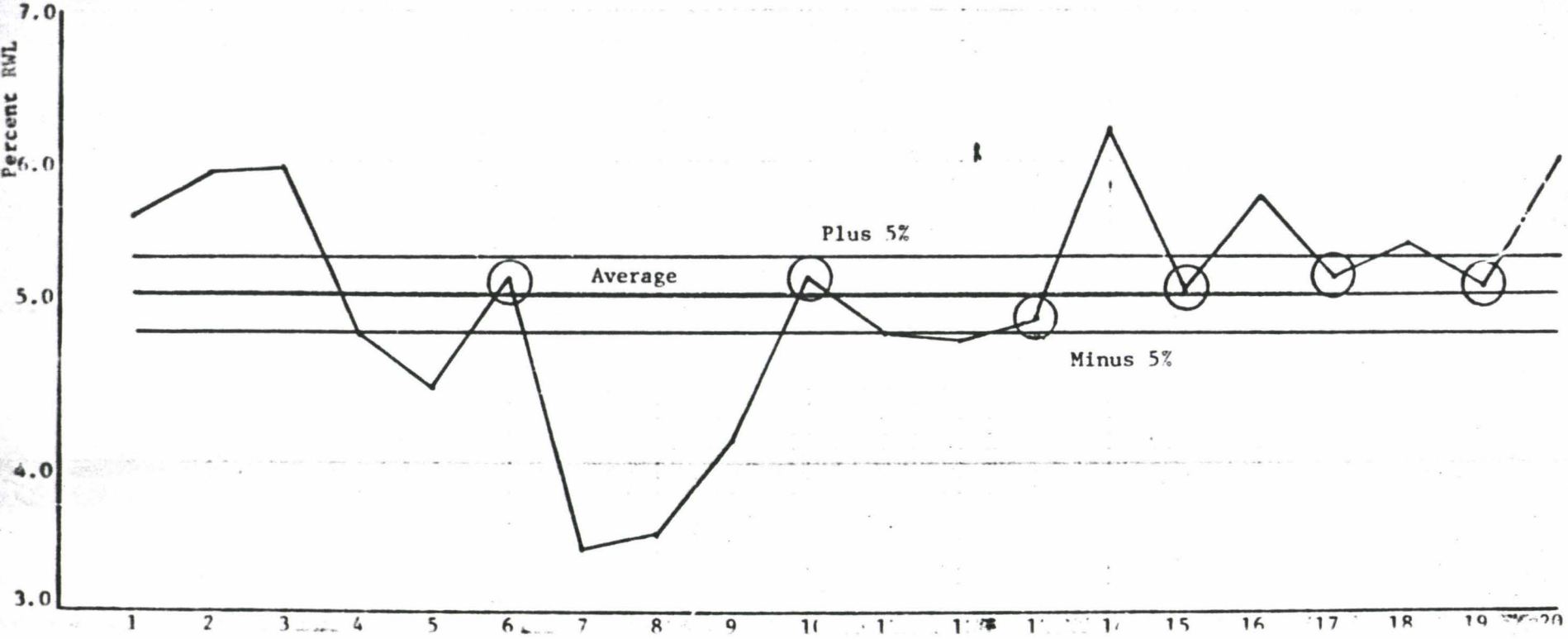
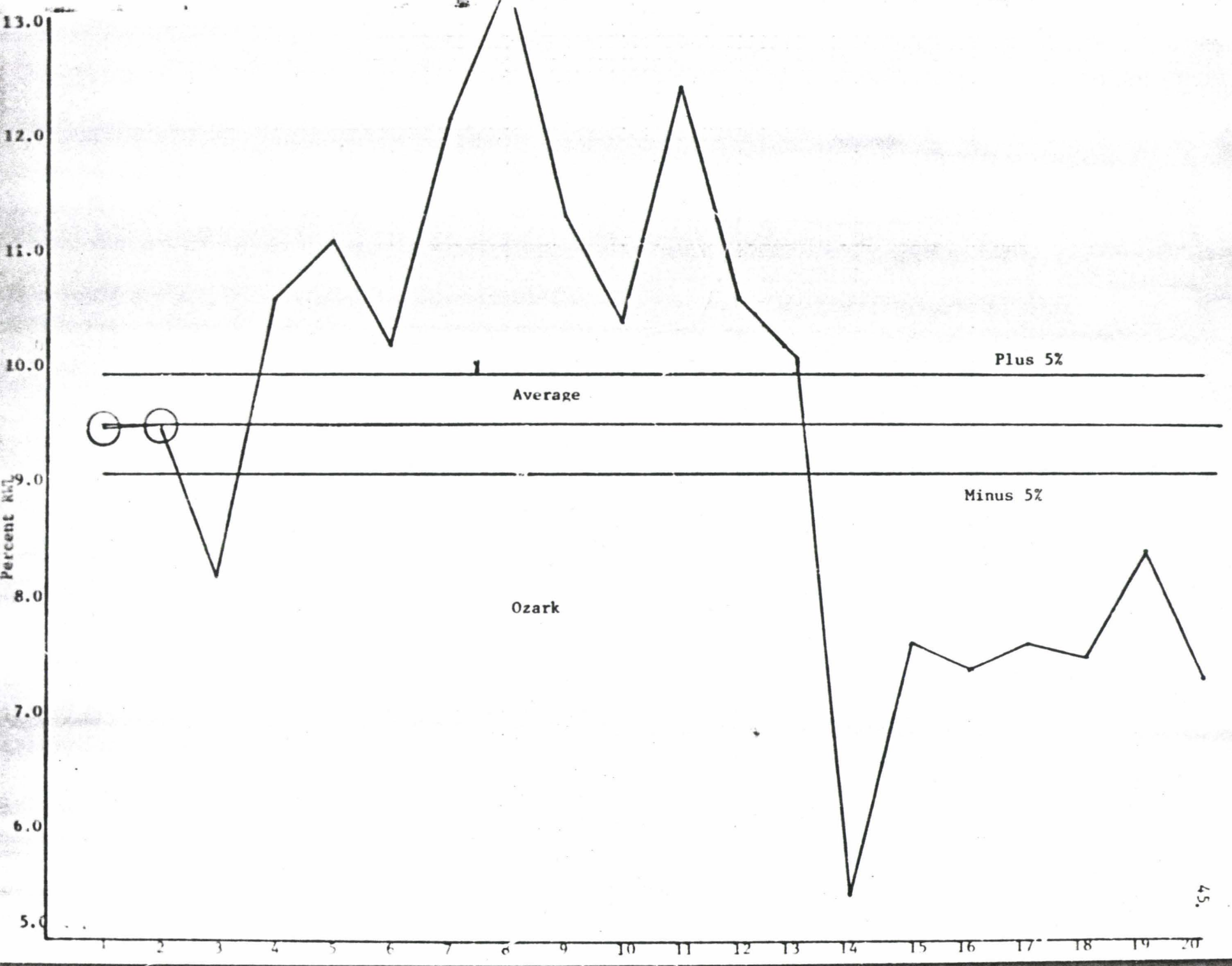
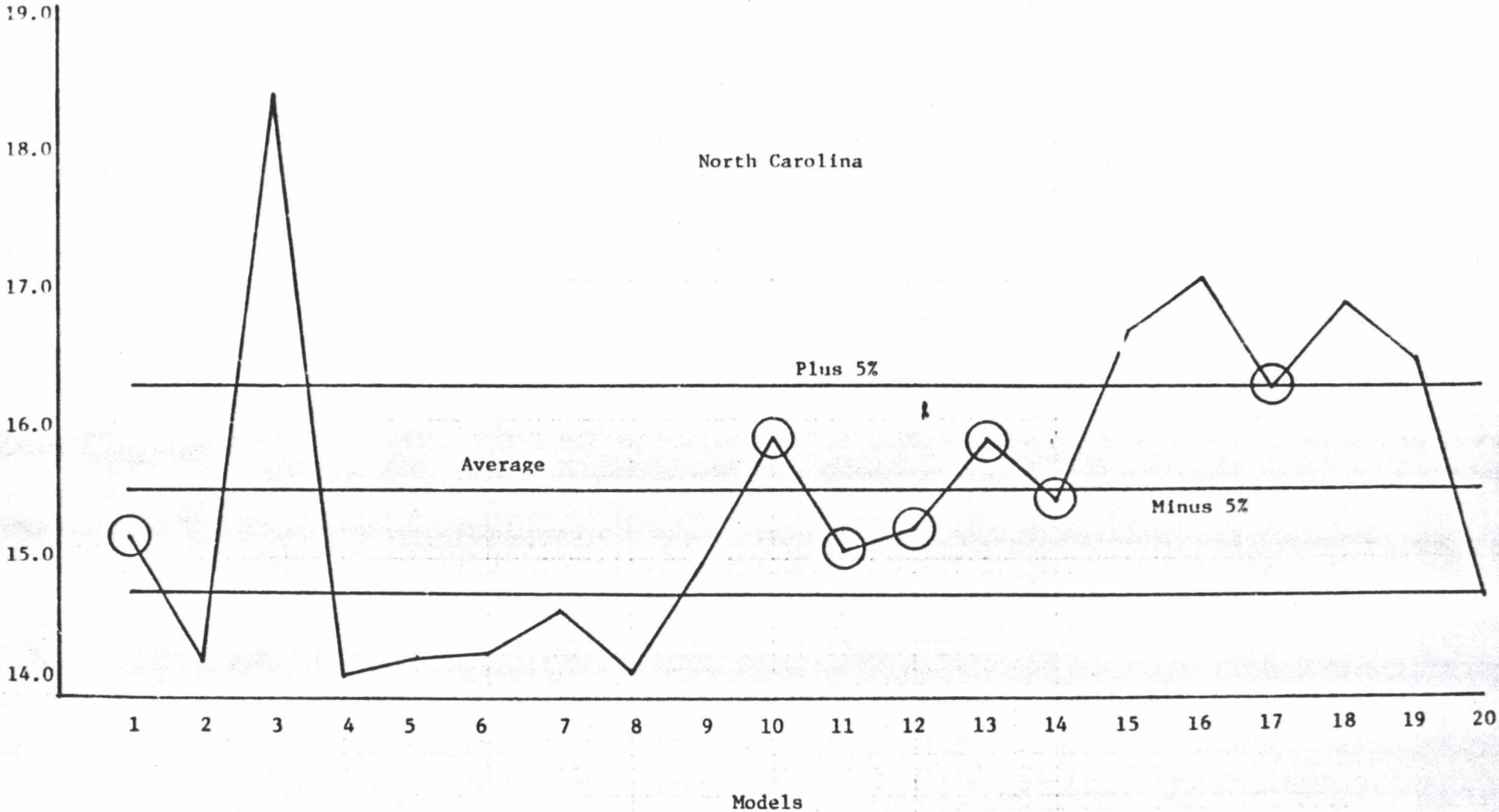
19
20
Models

Ouachita


7.0
6.0
5.0
4.0
3.0
Percent RWL
Plus 5%
Average
Minus 5%
1
2
3
4
5
6
7
8
9
10
15
16
17
18
19
20


13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
Percent RET
Plus 5%
Average
Minus 5%
Ozark
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


19.0
18.0
17.0
16.0
15.0
14.0
North Carolina
Plus 5%
Average
Minus 5%
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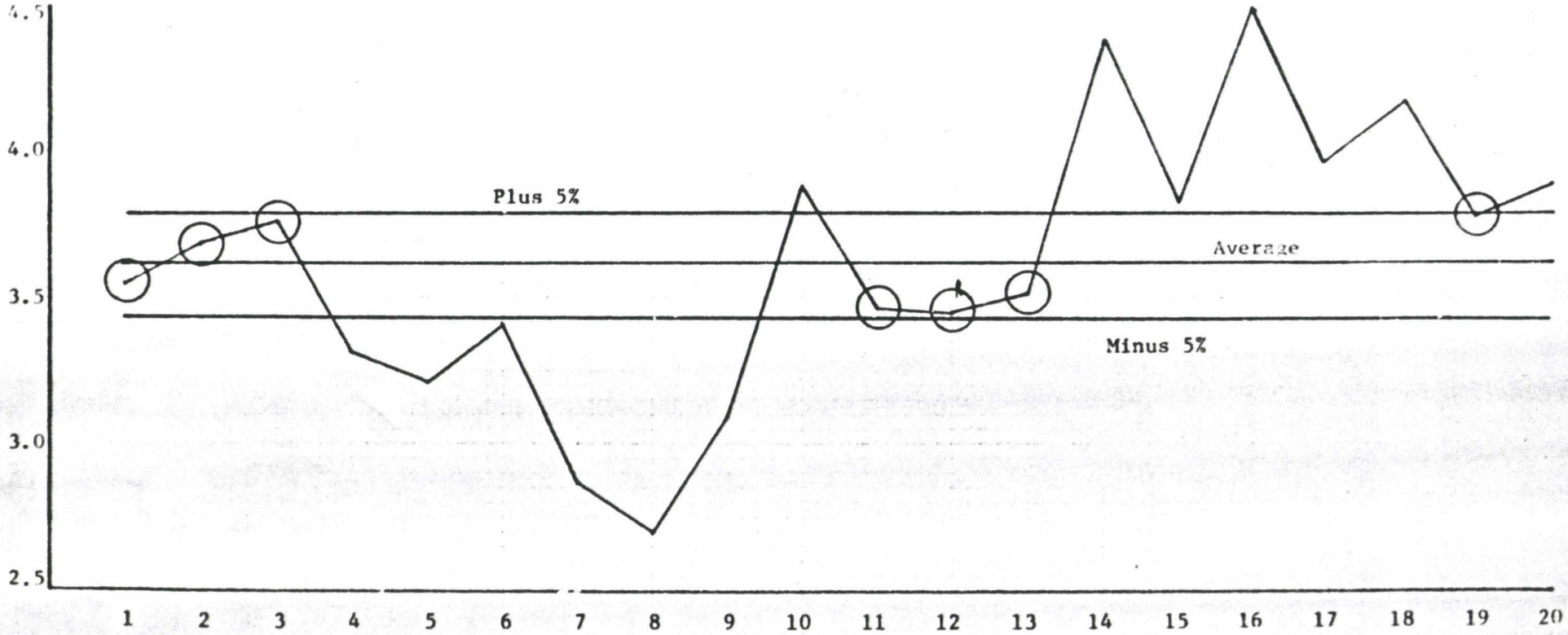
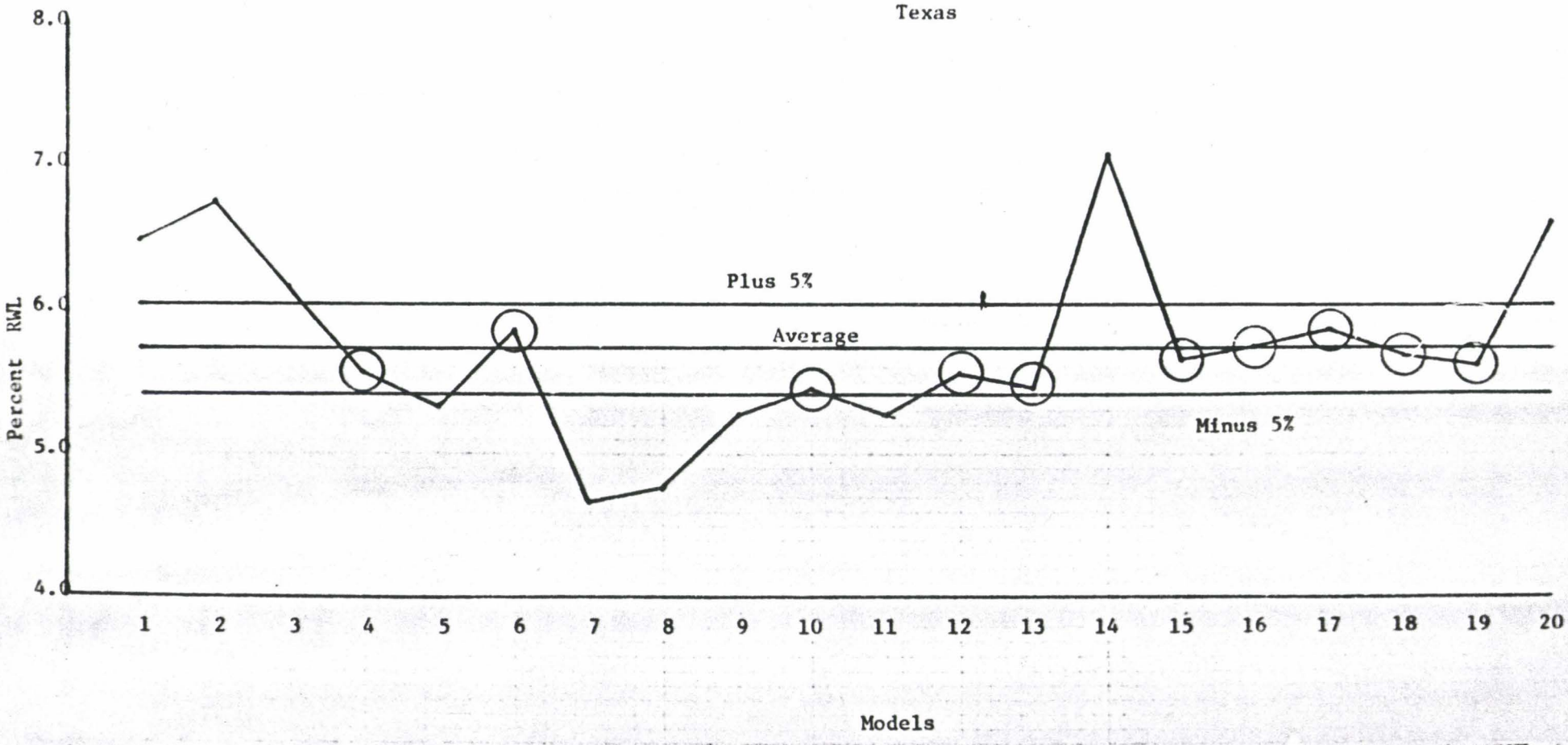
Models

Francis Marion & Sumter




Texas
8.0
7.0
6.0
5.0
4.0
Percent RWL
Plus 5%
Average
Minus 5%
1
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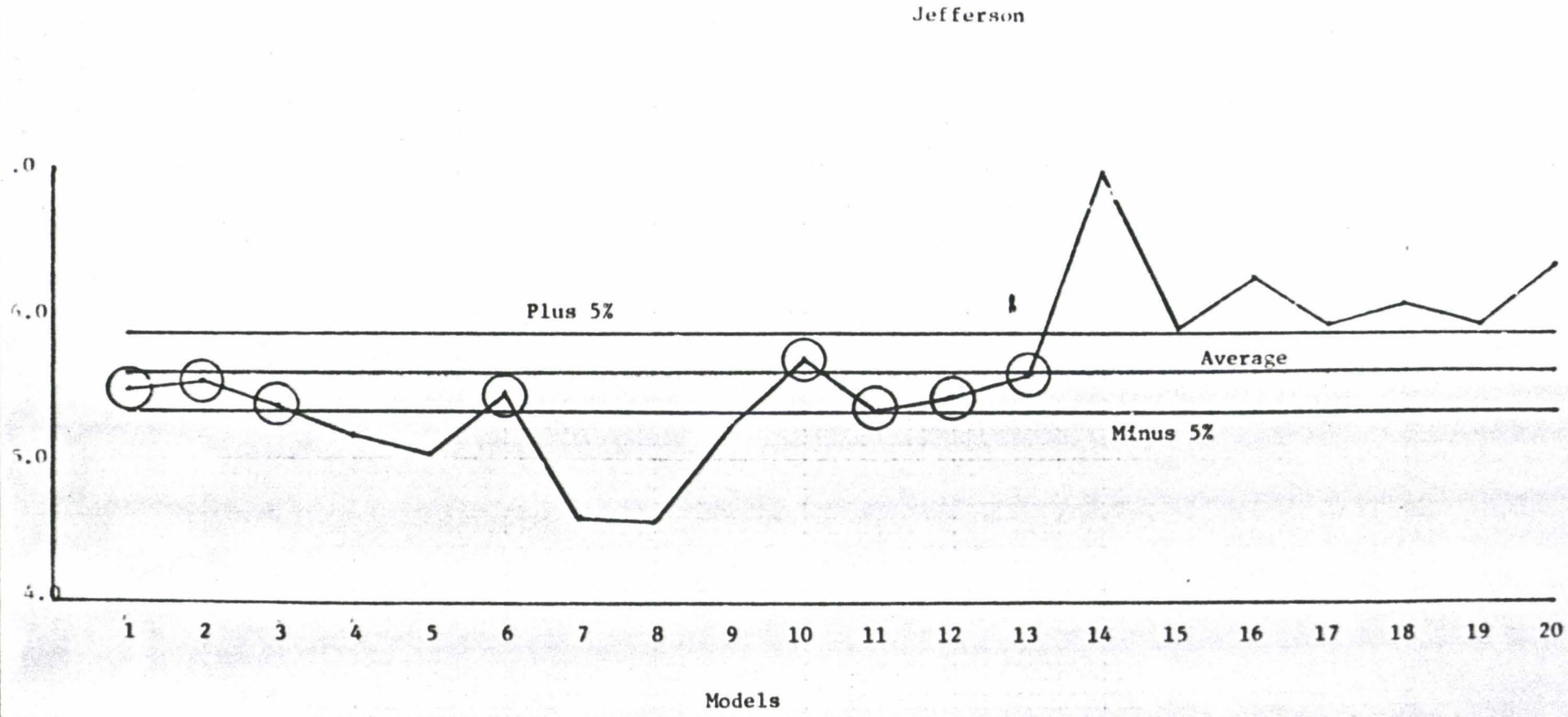
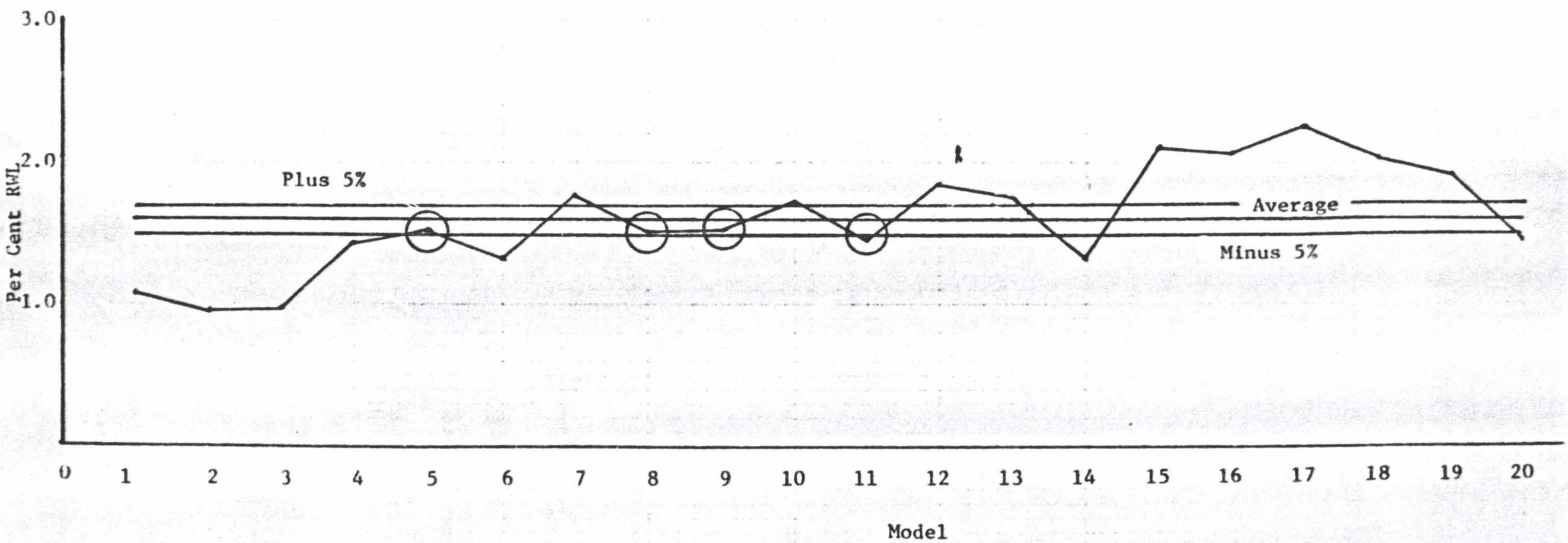
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Models


Jefferson
.0
6.0
5.0
4.0
Plus 5%
Average
Minus 5%
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Models

Caribbean


3.0
2.0
1.0
Per Cent RWL
Plus 5%
Average
Minus 5%
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
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18
19
20
Model

APPENDIX F

DEVIATION FROM THE AVERAGE

	#6	#10	#13	#15	#19	#12
Alabama	.0059	.0654	.0109	.0120	.0503	.0115
Daniel Boone	.0718	.0302	.0002	.0088	.0188	.0035
Chatt.-Oconee	.0064	.0717	.1012	.0453	.0240	.0078
Cherokee	.0275	.0046	.0642	.0598	.0043	.0362
Florida	.0539	.0027	.1032	.0001	.0038	.0881
Kisatchie	.0401	.0130	.0205	.0220	.1058	.0877
Mississippi	.0116	.1188	.0364	.0122	.0354	.0514
George Washington	.1002	.0087	.0913	.0205	.0775	.0376
Quachita	.0194	.0247	.0593	.0268	.0117	.0156
Ozark	.0714	.0904	.1108	.0561	.2008	.1170
North Carolina	.0764	.0243	.0174	.0174	.0771	.0622
FM Sumter	.0554	.0720	.0451	.0307	.0603	.0471
Texas	.0184	.0503	.0305	.0467	.0122	.0246
Jefferson	0249	.0175	.0275	.0014	.0549	.0569
Caribbean	.1806	.0631	.1563	.1163	.3125	.3763
TOTAL	.7639	.6574	.4761	1.0494	1.0235	.8748
AVERAGE	5.09%	4.38%	3.17%	7.00%	6.82%	5.83%

APPENDIX G

REFERENCES CITED

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